

High sensitivity flat SiO₂ fibres for medical dosimetry

ABSTRACT

We describe investigation of a novel undoped flat fibre fabricated for medical radiation dosimetry. Using high energy X-ray beams generated at a potential of 6 MV, comparison has been made of the TL yield of silica flat fibres, TLD-100 chips and Ge-doped silica fibres. The flat fibres provide competitive TL yield to that of TLD-100 chips, being some 100 times that of the Ge-doped fibres. Pt-coated flat fibres have then been used to increase photoelectron production and hence local dose deposition, obtaining significant increase in dose sensitivity over that of undoped flat fibres. Using 250 kVp X-ray beams, the TL yield reveals a progressive linear increase in dose for Pt thicknesses from 20 nm up to 80 nm. The dose enhancement factor (DEF) of $(0.0150 \pm 0.0003) \text{ nm}^{-1} \text{ Pt}$ is comparable to that obtained using gold, agreeing at the 1% level with the value expected on the basis of photoelectron generation. Finally, X-ray photoelectron spectroscopy (XPS) has been employed to characterize the surface oxidation state of the fibre medium. The charge state of Si2p was found to lie on 103.86 eV of binding energy and the atomic percentage obtained from the XPS analysis is 22.41%.

Keyword: Thermoluminescence; Dosimetry; Flat fibre; Ge-doped optical fibre